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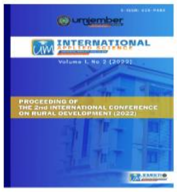

The first International Conference on rural development *"Increasing Rural Economy by Developing Strategy to Promote Tourism Village"* was held on Jun 13 - Jun 14, 2022, via Zoom Webinar (online) and Ahmad Zaenuri Hall Universitas Muhammadiyah Jember (Offline) due to the pandemic. ICRD 2022 aims to This international seminar will take sub-themes related to recovery from the impact of the Covid-19 pandemic from various study perspectives for the development of village areas, including the Development of tourism villages based on local wisdom, A new paradigm in learning in the digital era, Improving the local economy through tourist villages, Rural economic recovery after PPKM, Resilience, and mental health go hand in hand with pandemic conditions, Governance policies in the digital era, Parenting and communication patterns of parents and children in the digital era, Healthy Food, Development of natural resources, Human resource development, Development of appropriate technology, agro-tourism, and other themes. ICRD 2022 will provide a unique interdisciplinary and multidisciplinary forum for researchers, practitioners, and educators to present and discuss innovations, trends, practical challenges faced, and smart solutions adopted in the social and exact fields of rural development.

At this conference, there were research and service papers carried out by several researchers from various institutions and universities, which were presented in parallel oral sessions. In addition, the committee also presented four keynote speakers, namely Drs. K. H. Salwa Arifin (Regent Of Bondowoso), Prof. Dr. Kittisak J (Henan University of Economics and Law, China), Dr. Ronny W, S.H., M.Hum Dr. Ronny W, S.H., M.Hum (Rector of Universitas Merdeka Pasuruan) Dr. Sema G. Dilna Dr. Sema G. Dilna (Cotabato State University, Philippines), Dr. H. Sandiaga S U, B.B.A., M.B.A (Minister of Tourism and Creative Economy), Modou JONGA (Department of Management and Public Policy, Gambia), Wahyu Nurkholis H S, (Renewable Energy and Energy Conservation, Department of Mechanical Engineering, Chiang Mai University, Thailand), Dr. Hanafi, M.Pd (Rector UM Jember) Dr. Bagus Setya R, M.Kom (UM Jember)

KEYWORDS

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Optimization Of Population And Concentration Of Liquid Organik Fertilizer On Growth And Production Of Sweet Corn (Zea mays saccharata Strut)

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Abstract: Sweet corn (Zea mays saccharata Strut) is a weel-known horticultural commodity and has been cultivated in various processed forms. Marked demand for sweet corn continues to increased, so market needs continue to grow and need to be maximized. This study aims to determine population optimization and concentration of liquid Organic fertilizer on the growth and production of sweet corn (Zea mays saccharata Strut). This study used a Factorial Randomized Block Design with 3 replications and consited of 2 factors. The first factor is population difference, P1:population 62,000 plant per hectare, P2: population 83,333 plant per hectare, P3:125,000 plant per hectare, while the second factor is concentration of liquid organic fertilizer, N1:without POC, N2:POC 45 ml/L, N3:POC 90 ml/L, N4:POC 135 ml/L. Differences in population significanly affected the parameters of plant height 42 DAP, stemp diameter 42 DAP, lenght of cob, diameter of cob, weight of cob. The best treatment of was obtained in the P1 treatment, which was 62,000 plant per hectare. NASA POC concentration significantly affected all parameters. The best treatment was obtained in the N4 treatment with a concentration ot 135 ml/L. The interaction between population differences and NASA POC concentration had a significant effect on the parameters of plant height at 42 DAP.

Keywords: crop population, liquid organic fertilizer, sweet corn, growth an production

INTRODUCTION

Sweet corn (*Zea mays saccharata* Strut) is a weel-known horticultural commodity and has been cultivated in various processed forms [1]. The market demand to sweet corn continues to grow, while productivity of sweet corn in Indonesia is still low, averaging 8.31 tons per hectare while potential for sweet corn can reach 15-18 ton hectare [2]. The low productivity of sweet corn can be coused by several factor, namely, the aplication of improper palnt cultivation process techniques, low climatic conditions and soil fertility and improper spacing. Some efforts to increase productivity are by using good varieties and regulating the number of plant populations or the right spacing and proper fertilization [3].

According to [4] plant population (planting distance) is one of the factors that ca affect crop yields. The purpose spacing is so that plants get an equel share of nutrient and sunlight that are sufficient and needed and make it easier to carry out plant maintenance. The condition of agricultural land where fertility is inadequate for the plant cultivation process, so to increased the productivity of sweet corn plant can be done whit several effort to apply good and adequate farming technology, namely, by implementing proper fertilization aimed at meeting the nutrients needed by plants. The selection of the type of fertilizer to be used depends on the amount and content of nutients in the fertilizer, its effect on the quality of the plant, the determination of the doze of fertilizer to be used, the need for tertilizer on the plant and recomendations for proper fertilization and the right time of fertilization [3].

The use or inorganik or chemical fertilizers can increased crop production but can also couse some negative impact on the soil. To reduce the negative impact caused by the use of synthetic fertilizer, the use of organic fertilizers can be used as an alternative. Organic fertilizer contain sufficient amounts of micro nutrients and are able to improve the physical, chemical, and biological properties of the soil [5]. Liquid organic fertilizer is a type of fertilizaer that is degraded by microorganism from fermented agricultural waste. Liquid organic fertilizer contains nutrients that can increase plant produkctivity, besides the liquid organic fertilizer does not demage the soil and is absorbed more quickly by plants than soil fertilizer. Application of liquid organic fertilizer can inreased soil porosity, soil weight and plant growth and production [6]. According to Ainiya [7], the used of liquid organic fertilizer on sweet corn can increase plant growth and production.

Based on Sangadji's researche [8], liquid organic fertilizer from NASA on sweet corn growth with parameters such as plant height, leaf area, lenght or corb with a concentration of 30 ml/L given 3 time wiht a total concentration of 90 ml/L/plot was very significantly different from concentration of 22.5 ml/L, 15 ml/L, 7.5 ml/L and without liquid organic fertilizer (NASA POC) and weight parameters of cobs showed that the results where not significantly different and only significantly different from the control. Research on the respons of growth and production of sweet corn (Zea mays saccharata Strut) to population optimization and concentration of liquid organic fertilizer is expected to provide optimal result and have an effect of both growth and production of sweet corn. The purpose of the study was to determine the effect of different in plant density and concentration of liquid organic fertilizer on the growth and production of sweet corn.

METHOD

Experimental Site

This research was conducted in the experimental garden of the Faculty of Agriculture, Muhammadiyah University, Jember, Jember, East Java, Indonesia, with a height of 89 meters above sea level, from November 2021 to January 2022

Experimental Design

The result was conducted in the form of factorial field experiment. The first factor is population difference, 3 levels; P1: 62,500 plant per hectare (80 cm x 20 cm), P2 : 83,333 plant per hectare (60 cm x 20 cm), P3 : 125,000 plant per hectare (40 cm x 20 cm) and the second factor is 4 level liquid organic fertilizer (NASA POC) consentration; N1 : without liquid organic fertilizer, N2 : 45 ml/L liquid organic fertilizer, N3 : 90 ml/L liquid organic fertilizer, N4 : 135 ml/L liquid organic fertilizer. The treatment above were arranged using a Complete Randomized Block Design (RCBD) which was repeated three times.

Stastitical Analysis

Data collected in the analysis of variance (ANOVA), and the average test for population difference and liquid organic fertilizer consentration difference was compared using the DMRT test at 5% level,

Research Implementation

Land preparation is carried out by clearing the land of garbage, weeds or unwanted vegetation, than processing the land and making 36 plots with a size of 2x2 m, the distance between plots is 0.5 m, the distance between bloks is 1 m. Sweet corn seeds were sorted and planted in a single way with difference spacing according to treatment, the number of perforated seeds was 2 seeds. Planting is carried out at a depth of 5 cm.

Watering is carried out every day in the morning and evening according to soil conditioning and rainfall. Sweet corn thinning is done by breaking unwanted plants without having to remove them. Embroidery is carried out whent dead plants are found or their growth in not optimal. Thinning and replanting was done when the plants were 14 days after planting. Weeding is done when the plants are 15 and 30 days after planting. The covering of plant roots that arise above the soil surface which aims to strengthen the plant, it is more effective if done in conjunction with weeding.

Fertilization is very neccesary becouse it can meet the nutrient needed by plant. Fertilization is done by giving 100 g/plot equivalent to 250 kg/ha, phonska 120 g/plot equivalent to 300 kg/ha. The dose is given 7 and 30 days after planting. The given liquid organic fertilizer according to the treatment.

Table 1. Liquid Organic Fertilizer (NASA POC) Consentration Treatment

Liquid Organic Fertilizer Consentration (NASA POC)	14 day after planting (DAP)	28 day after planting (DAP)	42 day after planting (DAP)
N0 : 0 ml/l/plot	0 ml/l/plot	0 ml/l/plot	0 ml/l/plot
N1: 45 ml/l/plot	15 ml/l/plot	15 ml/l/plot	15 ml/l/plot
N2 : 90 ml/l/plot	30 ml/l/plot	30 ml/l/plot	30 ml/l/plot
N3 : 135 ml/l/plot	45 ml/l/plot	45 ml/l/plot	45 ml/l/plot

It is necessary to control pest and deseases, especially if the plants show symptoms of attact. Control is done manually by hand, but if the symptoms of pest and deseases attacts are not controlled, than spraying with furadan insectiside is carried out. Sweet corn is harvested when the plants are 60-70 days after planting. The carracteristics of sweet corn ready to harvest are the sweety corn cobs are full, the color of the seeds has turned yellow, the color of the leaves has turned yellow, the corn hair is brownish. The research parameters are as follows : 1). Plant heigh, 2). Stem diameter, 3). Number of leave, 4). Cob length, 5). Cob diameter, 6). Cob weight and 7). Number of seed per cob.

RESULTS AND DISCUSSION

Plant Heigh of Sweet Corn

Observation data on the difference population, NASA POC concentration and interaction of both of them on the plant heigh 42 DAP showed a significantly different effect. DMRT analysis result (Table 2) the effect of population different (P) show that population 125,000 plants/ha show the highest plant heigh (172.38 cm), this result is significantly different for population 62,000 plants/ha (P1). While the effect of POC NASA shows that NASA POC consentration 135 ml/L (N4) showing the highest plant heigh (179.44 cm). The result is significantly different for other treatment. While interaction between plant population and NASA POC, treatment with population 125,000 plants/ha and NASA POC consentration 135 ml/L the same with population 83,333 plants/ha and NASA POC 135 ml/L show the highest plant heigh 180.60 cm (P3N4) and 180.27 cm (P2N4). The result is significantly difference for other treatment interaction.

Table 2. Average plant heigh of Sweet Corn in population (P), NASA POC and interaction between population and NASA POC.

Plant Population (P)	Average PH **(cm), 42 DAP	Interaction (PN)	Average PH **(cm), 42 DAP
P1 (62,000 plants/ha)	165.23 b	P1N1	141.67 e
P2 (83,333 plants/ha)	171.98 a	P1N2	171.13 bc
P3 (125,000 plants/ha)	172.38 a	P1N3	170.67 bc
POC NASA Concentration (N)	Average PH **(cm), 42 DAP	P1N4	177.47 ab
		P2N1	156.73 d
		P2N2	176.33 ab
N1 (Without POC)	153.38 c	P2N3	174.60 ab

Plant Population (P)	Average PH **(cm), 42 DAP	Interaction (PN)	Average PH **(cm), 42 DAP
N2 (POC 45 ml/L)	172.36 b	P2N4	180.27 a
N3 (POC 90 ml/L)	174.29 b	P3N1	161.73 cd
N4 (POC 135 ml/L)	179.44 a	P3N2	169.60 bc
		P3N3	177.60 ab
		P3N4	180.60 a

Note : numbers shown with the same letters in the same column show no significant difference in DMRT 5%.
** : PH = Plant heigh

Stem Diameter of Sweet Corn

Observation data on the different population and NASA POC concentration the stem diameter showed a significantly difference effect. The interaction between plant population and NASA POC on the stem diameter on sweet corn shows not significant effect. The results of DMRT analysis of (Table 3) the effect of population different (P) show that population 125,000 plants/ha show the lowest stem diameter (20.97 mm), this result is significantly different for population 62,000 plants/ha (P1) and 83,333 plant/ha (P2). While the effect of NASA POC shows that NASA POC consentration 135 ml/L (N4) showing the highest stem diameter (23.38 mm). The result is significantly difference for other treatment.

Table 3. Average Stem diameter of Sweet Corn in population (P), and NASA POC Consentration (N)

Population (P)	Average SD** (mm)	NASA POC consentration (N)	Average SD** (mm)
P1 (62,000 plants/ha)	21.99 a	N1 (Without POC)	19.22 c
P2 (83,333 plants/ha)	21.81 a	N2 (POC 45 ml/L)	21.73 b
P3 P3 (125,000 plants/ha)	20.97 b	N3 (POC 90 ml/L)	22.03 b
		N4 N4 (POC 135 ml/L)	23.38 a

Note : numbers shown with the same letters in the same column show no significant difference in DMRT 5%.
** SD = Stem Diameter

Number of leave of Sweet Corn

Observation data on the NASA POC concentration on number of leave of sweet corn showed a significantly different effect, but to plant population and interaction of both of them showed not significant effect. DMRT analysis result (Table 4) the effect of NASA POC shows that NASA POC consentration 135 ml/L (N4) showing the highest number of leave of sweet corn (11).

Table 4. Average Number of Leave of Sweet Corn to NASA POC Consentration

NASA POC consentration (N)	Average NL **
N1 (Without POC)	9.53 c
N2 (POC 45 ml/L)	10.47 b
N3 (POC 90 ml/L)	10.69 b
N4 N4 (POC 135 ml/L)	11.09 a

Note : numbers shown with the same letters in the same column show no significant difference in DMRT 5%.
** NL = Number of Leave

Cob Lenght of Sweet Corn

Observation data on the difference population and NASA POC concentration on the cob lengt of sweet corn showed a significantly different effect, but interaction between them showed not significant effect. DMRT analysis result (Table 5) the effect of population different (P) show that population 62,000 plants/ha show the highest cob lenght (20.63 cm), this result is significantly different for population 125,000 plants/ha (P3). While the effect of POC NASA shows that NASA POC consentration 135 ml/L (N4) showing the highest cob lengt of sweet corn (21.18 cm). The result is significantly different for other treatment.

Table 5. Average Cob Lenght of Sweet Corn in population (P), and NASA POC Consentrasion (N)

Population (P)	**Average CL** (cm)**	**NASA POC consentration (N)**	**Average CL** (cm)**
P1 (62,000 plants/ha)	20.63 a	N1 (Without POC)	19.07 c
P2 (83,333 plants/ha)	20.27 ab	N2 (POC 45 ml/L)	20.49 b
P3 P3 (125,000 plants/ha)	20.00 b	N3 (POC 90 ml/L)	20.47 b
		N4 N4 (POC 135 ml/L)	21.18 a

Note : numbers shown with the same letters in the same column show no significant difference in DMRT 5%.

** CL = Cob Lenght

Cob diameter of Sweet Corn

Observation data on the difference population and NASA POC concentration showed a significantly different effect, but interaction of both of them on the cob diameter of sweet corn showed not significant effect. DMRT analysis result (Table 6) the effect of population different (P) show that population 125,000 plants/ha show lowers of cob diameter (51.56 cm), this result is significantly different from other treatment. While the effect of NASA POC consentration 135 ml/L (N4) showing the cob diameter (56,42 cm). The result is significantly different for other treatment.

Table 6. Average Cob Diameter of Sweet Corn in population (P), and P NASA POC Consentration (N)

Population (P)	**Average CD** (cm)**	**POC NASA consentration (N)**	**Average CD** (cm)**
P1 (62,000 plants/ha)	53.58 a	N1 (Without POC)	50.20 c
P2 (83,333 plants/ha)	54.19 a	N2 (POC 45 ml/L)	54.06 b
P3 P3 (125,000 plants/ha)	51.56 b	N3 (POC 90 ml/L)	55.08 ab
		N4 N4 (POC 135 ml/L)	56.42 a

Note : numbers shown with the same letters in the same column show no significant difference in DMRT 5%.

** CD = Cob Diameter

Cob Weight of Sweet Corn

Observation data on the difference population and NASA POC concentration showed a significantly different effect, but interaction of both of them on the cob weight of sweet corn showed not significant effect. DMRT analysis result (Table 7) the effect of population different (P) show that population 125,000 plants/ha show the lowest cob weight (214.98 gram), this result is significantly different for other treatment. While the effect of NASA POC shows that NASA POC consentration 135 ml/L (N4) showing the highest cob weight (280.56 gram). The result is significantly different for other treatment.

Table 7. Average Cob Weight of Sweet Corn in population (P), and NASA POC Consentration (N)

Population (P)	Average CW** (gram)	NASA POC consentration (N)	Average CW** (gram)
P1 (62,000 plants/ha)	239.29 a	N1 (Without POC)	193.62 d
P2 (83,333 plants/ha)	224.89 a	N2 (POC 45 ml/L)	230.04 c
P3 P3 (125,000 plants/ha)	214.98 b	N3 (POC 90 ml/L)	255.49 b
		N4 N4 (POC 135 ml/L)	280.56 a

Note : numbers shown with the same letters in the same column show no significant difference in DMRT 5%.
** CW = Cob Weight

Number of seed per cob of Sweet Corn

Observation data on the NASA POC consentration showed a significantly difference effect. While plant population and interaction of both of them on number of seed per cob of sweet corn showed not significantly different effect. DMRT analysis result (Table 8) the effect of POC NASA shows that NASA POC consentration 135 ml/L (N4) showing the highest number of seed per cob (770). The result is significantly different for other treatment.

Table 8. Average Number of seed per cob of Sweet Corn to POC NASA Consentrasion

NASA POC consentration (N)	Average NSC **
N1 (Without POC)	571.16 c
N2 (POC 45 ml/L)	660.00 b
N3 (POC 90 ml/L)	694.58 b
N4 N4 (POC 135 ml/L)	769.53 a

Note : numbers shown with the same letters in the same column show no significant difference in DMRT 5%.
** NSC = Number of seed per cob

Discussion

Plant population of sweet corn

Iuspected it is suspected that the population of 125 plant/ha obtained the highest average value becouse the use of dense populations can increase plant height. Maddoni et.al [9] suggest that the treatment of dense population can increase production to be heigher. Waxn and Stoller, (1987) in [10] said that basically the aplication on tight spacing aims to increase yields, provided that limiting factors can be avoided so that there is no competition between plans with each other. According to Erawati and Hipi [11] the use of dense plant population will tend to couse plants to grow taller, becouse they have limited plant space, so plant will tray to find sunlight by extending plant organs such as leaves and stems.

Plant population or plant spacing related to plant density effect the acquisition of sunlight that can be use for photosynthesis. The process of photosynthesis will determine the accumulation of photosynthate which is useful to plant growth. Plant growth is strongly influenced by the level of photosynthate produced through the process of photosynthesis [12]. The use of loose plant population can affect the competition for plant nutrient so that production results, namely the lengh of the cob, are more optimal. According to Sasvita et.al [13], a wide plant population has a smaler level of competition between plant so that it can affect plants in the process of taking nutrient, water, oxygen and sunlight, so as to minimize compotition for nutritional needs between plants.

Fitter and Hay (1991) in Erawati and Hipi [11], stated the plant population that is too dense causes a reduction in the supply of nutrients to the shoots caused by competition or compotition for roots in absorbing plant nutrients will reduce shoot efficiency and consequently will reduce the flow of assimilated product to the root fungtion which can further interfere with the stage of the plant entering the generative period. Good vegetative growth can make good generative growth as well. According to Purwono and Hartono (2005) in Erawati and Hipi [11] sweet corn plants really need sunlight. Corn plants that are shaded or shade each other, their growth will be hampered, so that the seed yields that are formed are not good, even cob cannot form.

It is suspected that the use of loose population can minimize competition between plants for nutriens so that in the generative periode the plants can meet the nutient needs of plants optimally and affect the weight of the cobs. According to [14], increasing plant population per unit area, can increase the number of plant populations so as to increase the production of these plants. Erwin et.al (2015) suggested that the role of population or the distance between plans in plant growth aims to maintain competition in the struggle for nutrients needed by each individual per plan.

NASA POC Consentration

It is suspected that the aplication of NASA POC with concentration of 135 ml/L from to macro and micro nutrient that are absorbed through the stomata can be used by plants during vegetatif growth, so as to provide the highest plant height response. It can be seen from the composition of the nutrient contained in the POC, namely N of 4.15%, where the nitrogen element applied through the leaves will be absorbed more quickly by the stomata and utilized by plants through the process of photosynthesis with the help of sunlight. Some experts in plant physiology suspect that apart from being absorbed by leaf stomata, nutrient absorption can also be carried out through ectodesmata [8]. Plant really need nitrogen, especially in the vegetative period. The availability of N in the vegetative period can make plants fresher and have a lot of chlorophyl. The availability of chlorophyl is very important in process of photosynthesis, one of which is to accelerate plant growth [15].

The use of POC with a higher consentration can meet the needs of plant nutrients so that it can affect the acceleration of plant stem diameter growth. This is becouse the energy generated from NASA's POC nutrients in plants can optimized plant growth. According to [16], NASA's POC can stimulate the formation of polyphenols. This compound is one that plant need to plant resistance to be resistant to pest and deseases. The main nutrient element for plant growth is nitrogen becouse it is a contituent of amino acids, amides and nucleoproteins which a important elements in cell division. Good cell division can help plant growth becouse growth is an increase in size, volume, weight and number of cells. In addition, nitrogen has a fungtion in increasing the amount of chrorophyl, so that if N is available in sufficient quantities, it can increase the rate of photosynthesis so that more photosyntate is formed [8].

The aplication of 135 ml/L POC can also increase the length of the cob becouse with this consentration it can meet the needs of nutrient needed by plant in the generative phase, one of whice is P ang K element. According to [17]element P can affect the development of cob ang seed size and nutrient K plays a role in accelerating the translocation of nutrient increasing the quality of cob. Sidar [18] suggested that the P element is needed by corn plant in the generative growth phase for the formation of cobs and if the lack of P element can couse cob development not optimal and couse uneven seeds. Mahdiannoor et.al [19]argue that

P can affect the formation of corn cobs. Phosphorus nutrients can increased fruit fomation, beside the availability of P can be use as a form Adenosine Triphosphate (ATP) will ensure availability of energy for growth so that the formation of asimilate and transport to storage can run well.

Associated with the higher availability of nutrient, especially macro nutrien N, P and K in the soil. Sutejo [20] suggested that the function of N in vegetable plant is as a protein constituent, for plant growth ang fertilizing vegetative growth. The function of P as one of the constituent elements of protein, is needed during the periode of flower, fruit and seed formation, and can stimulate root growth to become elongated and strong so that plants will be drought resistant. Elemental K functions in metabolic processes such as photosynthesis and respiration, which are important for growth. The generative period of plants in the formation of seeds really needs phosphorus (P) and potassium (K) elements if there are sufficient nutrients than seed formation will be more optimal. According to Palungkun and Budiarti (1995) in [5] the element of phosphorus (P) is needed in the process of forming seeds to be perfect, if there is a lack of phosphorus (P) the formation of seeds in row is not perfect and has smaller seed size. Effendi (1990) in Prasetyo et.al (2013) suggested that in addition to a lack of phosphorus (P), a lack of potassium (K) can couse the development of cabs and seed formation to be imperfect, and the tip of the top of the cob does not contain.

Plant Population Interaction with POC NASA Consentration

The combination of treatment between plant populations and NASA’s POC concentration support each ather, so that plant can respons well. This is what couse plant photosynthesis to run well. According to Erawati and Hipi [11]the use of dense plant population will tend to cause plant to grow taller, becouse they have limited plant space, so plants will tray to find sunlight by extending plant organs such as leaves and atems. The supporting factor is the N content in NASA’s POC which can meet the nutritional needs of plants. This can be seen from the composition of the nutrients contained in the POC, namely N by 4.15%, where the N (Nitrogen) which is applied through the leave will be absorbed more quickly by the stomata and utilized by plants through the process of photosynthesis with other assistance, namely sunlight [8].

CONCLUSION

The spacing of sweet corn (plant population) had an effect on plant heigh 42 DAP, stem diameter, cob length and cob weight. Treatment of plant population of 62,000 plant/ha gave the best result on growth and production of sweet corn. Treatment of concentration of liquid organic fertilizer (POC) affects all treatment parameters. The concentration of NASA’s POC 135 ml/l gives the best result. The interaction between the treatment of plant population and the concentration of NASA’s POC significantly affected plant height 42 DAP. Population of 62,000 plant/ha gave the best results on sweet corn plant parameters.

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